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ABSTRACT

The purpose of the School Improvement Model (SIM) Project is to investigate the links between systematically developed teacher performance evaluation, administrator performance evaluation, staff development interventions, and the quality of education as measured by student achievement results. Following the 4th year of the 5-year study, preliminary findings made possible the development of a model of the effects of SIM project activities on student performance, based on results obtained in the Minneapolis Public Schools. Fourth-grade mathematics scores on norm-referenced tests served as measures of achievement, and both the classroom level and the individual student level of improvment were tested, using analysis of covariance. Variables tested included socioeconomic status, race, and attendance. Socioeconomic status and race were found to predict both pretest and posttest scores, but evidence indicated that the SIM process reduces the impact of these variables and does affect achievement in a metropolitan school setting. (PGD)

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SCHOOL IMPROVEMENT MODEL--A TOTAL SYSTEMS APPROACH TO TEACHER, ADMINISTRATOR, AND STUDENT PERFORMANCE EVALUATION

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Abstract

The model presented in this paper describes the guidelines which will be used to evaluate the effect of the Northwest Area Foundation School Improvement Model activities on student achievement. The plan includes two major components: testing group differences when classroom is the unit of analysis and evaluating the path model describing the effect of sets of predictor variables on student achievement. The feasibility of the protocol was tested and results presented. The process described in this paper will be used in the final analysis of the SIM project during fall, 1984.

INTRODUCTION

Striving for excellence in education is a goal of all school personnel committed to the education of our nation's children. Recent national reports indicate that goal is shared by other groups as well (National Commission on Excellence in Education, 1983; The Twentieth Century Fund, 1983; Education Commission of the States, 1983). Controversy over the proposed solutions to the problems identified in these reports highlights the continued need for research of conditions that produce excellent schools. Variables associated with outstanding schools have been identified (Rutter et al., 1979) some of which are alterable (academic emphasis, teacher behaviors) and others of which are unalterable (student socioeconomic status, race). An important step on the path to effective schools is the identification of a process which encourages and develops conditions that improve the quality of schools.

The purpose of the School Improvement Model (SIM) Project is to investigate the links between systematically developed teacher performance evaluation (TPE) (Blackmer et al., 1981), administrator performance evaluation (APE) (Look and Manatt, 1983), staff development interventions, and the quality of education as measured by student achievement results (Ruebling, 1983). It is an attempt to identify and implement a process of school improvement designed to incorporate these alterable links.

The SIM Project is funded by the Northwest Area Foundation, St. Paul, Minnesota, and the five school organizations which make up the SIM Consortium. The project is administered by the College of Education,

Iowa State University, Ames, Iowa. Dick Manatt and Shirley Stow are Co-Directors. A successful effort was made to involve a variety of types of school systems: a large urban school organization, Minneapolis Public Schools; a suburban school organization, Edina Public Schools; a private school, Breck School; a medium-sized school organization in a generally rural area, Northfield Public Schools; and a small school organization in a rural setting, Spirit Lake Community School District.

The project spans a five-year period. The first year consisted of planning. During the second year, teacher and administrator performance evaluation criteria, procedures, and instruments were drafted and student achievement tests were developed and selected. This resulted in a unique set of instruments for each organization. The third year of the project was desginated as a test-and-try year. TPE and APE materials, the CRT tests developed, and the NRT tests selected to measure student achievement were pilot-tested. The trial results guided final revisions in TPE, APE, achievement tests, and operational procedures for the performance appraisal and achievement testing. Also, staff development interventions were selected for implementation. Each organization implemented its unique system during year four resulting in preliminary data that currently are being examined. Also, staff development interventions were conducted during year four. As all aspects of the model are in place for this fifth and last year of the project, the data collection will continue and the final evaluation of the project's effects on student achievement will be conducted.

This field based action project was limited to fourth grade math and reading, and eighth grade math content areas. Student performance measures were developed or selected in two forms: criterion-referenced tests (CRT) and norm-referenced tests (NRT). Each organization worked with project staff to determine the most appropriate instruments. Obviously, the CRT's employed by the organizations vary according to the curriculum objectives in each organization. Also, each school system had a NRT preference. Since the goal of the SIM project was not to compare across organizations, but to use repeated measures within organization, the unique testing program in each school does not jeopardize the study. In addition to student performance and race, attendance and SES data are available.

Although the success of the project will be documented and evaluated in many ways, this paper describes only one, a model to measure SIM's effect on student achievement. That is, although the project was designed to answer the following five questions, this paper discusses only question 4.

1. What changes in Administrative Leadership occurred?
2. What changes in Teacher Behavior occurred?
3. What changes in Student Performance occurred?
4. In the experimental organization, did project activities affect student performance?
5. What effect did the project have on low SES students?

In the experimental organization, the large school organization, one-third of the school units are involved with SIM; one-third received pre-

and posttesting but with no intervention; and one-third were administered the CRT and NRT posttest only. This design allows for analysis identifying strengths and weaknesses of the total system.

METHODS

The remainder of this paper outlines the techniques designed to answer question 4 above and exemplifies typical results based on preliminary data. The data available for analysis are from four levels: student, teacher or classroom, administrator, and building. Analysis of student achievement data occurs at the first two levels, student and classroom. First, using individual students as the unit of analysis, a path model will be tested and revised. Second, using classroom as the unit of analysis, differences in group student achievement will be examined.

Using fourth grade math norm-referenced test results, the model in Figure 1 was tested. The total mathematics score from the California Achievement Test was the criterion variable under investigation. The total score is comprised of the mathematics computation and mathematics concepts and applications subtests.

Project staff and school organization personnel worked together deciding on variables to include in the model. The basis for inclusion was past research findings (Rutter, et al., 1979; Peterson and Walberg, 1979) combined with evidence of face validity in the eyes of school personnel.

SES or socioeconomic status is a dichotomous variable, indicating whether or not a student participates in the free lunch program. Race

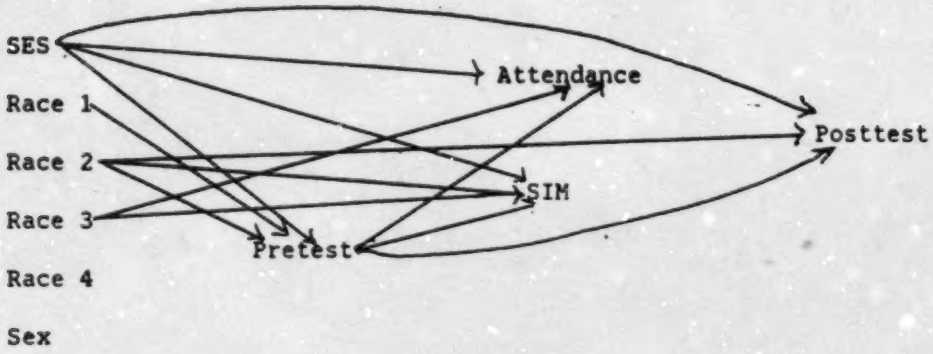

FIGURE 1. Hypothesized Causal Diagram: effect of SIM on individual student achievement

was recoded as dummy variables and the race codes are: 1=Indian American, 2=Black American, 3=Asian American, and 4=Hispanic American.

Preliminary analysis of the individual student data set included analysis of variance tests using the demographic categories as factors, pretest and attendance as covariates and the posttest score as the dependent variable to determine whether any interactions should be included in the model. No interactions were identified as significant, and therefore none are included.

Originally, Limited English Proficiency (LEP), a dichotomous variable, was included in the analysis. However, when the pretest and posttest scores were matched, most students with Limited English Proficieny dropped out of the sample. Also, when LEP was crossed with race there were several empty cells (See Table 1). Therefore LEP was omitted from analysis. Perhaps this phenomenon will not occur with the '83-'84 data set. If possible, LEP will remain in the final model.

TABLE 1. LEP x Race for students in experimental organization

LEP	RACE				
	Indian American	Black American	Asian American	Hispanic American	White American
Yes	1	0	30	2	0
No	101	464	42	21	1191

In addition to testing the path model for students, using classroom as the unit of analysis the analysis of covariance test was employed to determine whether there was a difference in posttest scores between the group of clasrooms involved in project activities and the group of classrooms not involved in SIM activities. Average pretest scores, posttest scores, and attendance were computed for each classroom. Also, percent of white students and percent of students not participating in free lunch were calculated for each classroom.

FINDINGS

The statistical analysis outlined above will be performed on the final complete data set during 1984, and at that time the overall effect of the project will be evaluated. This paper describes a method for that evaluation and presents an example of findings.

The relationships displayed in Figure 2 represent the results of investigating the proposed path model.

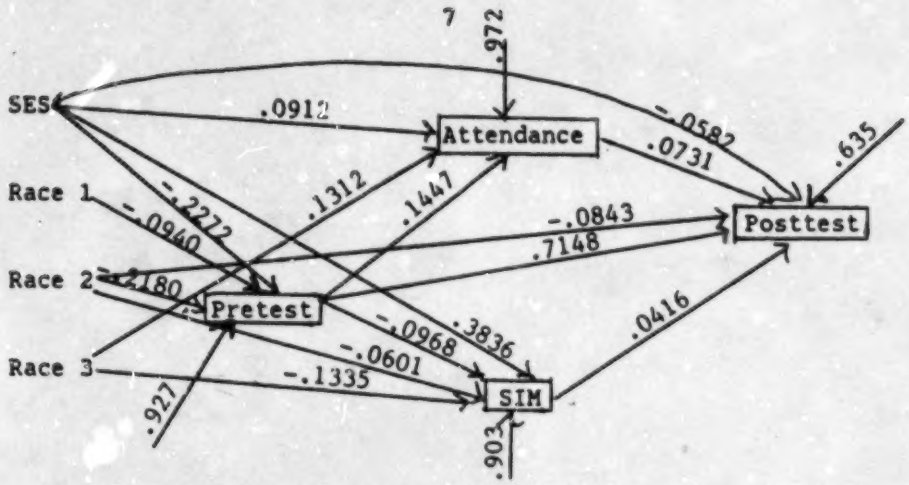

FIGURE 2. Resulting Causal Model: Effect of SIM on individual student achievement

Because the students were assigned to a school building and classroom according to traditional criteria rather than matching and then assigning students according to experimental criteria, the demographics of Group 1 (SIM schools) and Group 2 (non-SIM schools) were different (Table 2). This fact accounts for the relationship between the SIM variable and the three demographic variables (SES, Race 2, Race 3) in Figure 2. As was expected, race and socioeconomic status predicted pretest scores. Also, the student's pretest score, attendance record, and involvement in SIM predicted end of year achievement. It was hypothesized that the SES and Race effects on pretest and the pretest and SIM effect on posttest would eliminate Race and SES effects on posttest. However, according to the resulting model, low SES and Race 2 (Black American) continued to have a negative effect on posttest scores.

To further interpret the resulting model, the effects were decomposed into direct and indirect effects (Alwin and Hauser, 1975). Indirect effects are parts of the total effect transmitted as

TABLE 2. Characteristics of 4th grade math NRT student achievement data, groups 1 and 2

	Group 1 (SIM)	Group 2 (Non SIM)	TOTAL
N	621	496	1117
Mean Pretest*	37.24	43.50	40.02
Mean Posttest*	55.87	60.25	57.82
Mean Attendance	161.99	163.12	162.49
SES Percentages			
free lunch program (1)	66.7	27.8	49.4
no free lunch program (2)	33.3	72.2	50.6
Race Percentages			
American Indian	4.0	3.0	3.6
Black American	26.6	17.7	22.6
Asian American	2.3	6.3	4.0
Hispanic American	.8	1.4	1.1
White American	66.3	71.6	68.7

*Raw score means, total items on test n=85.

intervening between the cause and effect of interest, whereas the direct effect is the remaining effect when intervening variables have been held constant. The coefficients in Table 3 indicate that when the direct effects of SES and Race 2 are decomposed, predictable results were confirmed. These two demographics have a major impact on pretest scores and only minor, but nonetheless statistically significant, effect on posttest scores. The indirect effect of the pretest score on SIM and attendance is only minor, and as expected, pretest score is the best

TABLE 3. Interpretation of effects in the SIM model of individual student achievement

Dependent Variable	Pre-determined Variable	Total Effect	Indirect Effect via Pretest	Indirect Effect via SIM & Attend.	Direct Effect
Pretest	SES	-.2272	---	---	-.2272
	Race 2	-.2180	---	---	-.2180
	Race 1	-.0940	---	---	-.0940
Attendance	SES	-.1360	-.2272	---	.0912
	Race 3	.1321	.0009	---	.1312
	Fretest	.1447	---	---	.1447
SIM	SES	.4069	.0233	---	.3836
	Race 3	-.1305	.0030	---	-.1335
	Race 2	-.0402	.0199	---	-.0601
	Pretest	-.0968	---	---	-.0968
Posttest	SES	-.2235	-.1752	.0099	-.0582
	Race 2	-.2348	-.1464	-.0041	-.0843
	Pretest	.7211	---	.0063	.7148
	Attendance	.0731	---	---	.0731
	SIM	.0416	---	---	.0416

predictor of posttest score. The fact that SIM is an intervening variable between pretest and posttest supports further efforts in the school improvement direction. That is, there is evidence that the process outlined in the SIM project ~~positively~~ affects student achievement. The data used in these analyses were from year 4, when the implementation of the process was occurring. The final test of the effect of SIM will be done using data from the final year of the project.

The second stage of the analysis plan to investigate SIM's effect on student achievement involves classroom units rather than individual student. The student data were aggregated by classroom resulting in the background variables and values displayed in Table 4.

TABLE 4. Characteristics of aggregated 4th grade math NRT student achievement data, groups 1 and 2

	GROUP 1 (SIM)	GROUP 2 (NON SIM)	TOTAL
N	38	33	71
Mean Pretest*	37.33	44.39	40.61
Mean Posttest*	55.76	61.12	58.25
Mean Attendance	161.92	163.30	162.56
Percent White	64.68	73.06	68.57
Percent High SES	35.33	74.96	53.75

* Raw score means, total items on test n=85

Group 2 appears to have more than a five point advantage over Group 1 when posttest averages are compared. The analysis of variance results in Table 5 indicate that when initial SES and pretest differences between the groups are accounted for, there is a statistically significant difference between the posttest means of Group 1 and Group 2. At this point it is necessary to compare the means after adjusting

for initial difference shown in Table 6. The reader is cautioned in interpreting these results because of the large initial differences in the covariates.

TABLE 5. Analysis of variance posttest score by group with pretest score and SES as covariates using classroom as unit of analysis for group 1 and group 2

Source	SS	df	MS	F	p
Covariates					
Percent High SES	157.505	1	157.505	8.664	.004
Pretest	592.391	1	592.391	32.586	.000
Main Effects					
Group	114.747	1	114.747	6.312	.014
Explained	2078.638	3	692.879	38.114	.000
Residual	1218.003	67	18.179		
Total	3296.641	70	47.095		

Comparing adjusted means, the analysis of covariance results suggest that there is a statistically significant difference between Group 1 and Group 2 fourth grade math NRT scores, and that Group 1 scores approximately 3.1 raw score points higher than Group 2. The adjustments are based on the initial group differences on the pretest scores and the group differences on the SES variable. It may be noted that the SIM classrooms increased mean scores by 18.43 points and non-SIM schools increased by 16.73 points. Thus, the results from the

TABLE 6. Adjusted and Unadjusted Posttest Means

$\bar{X}$ Grand = 58.25
N = 71

	Group 1	Group 2
Unadjusted	$\bar{X}_1$ = 55.76	$\bar{X}_2$ = 61.12
	N = 38	N = 33
Adjusted	$\bar{X}_{1adj}$ = 59.14	$\bar{X}_{2adj}$ = 56.07

analysis at the classroom level concur with the results from the analysis at the student level except for the attendance factor. Individual student attendance made a statistically significant contribution to posttest prediction in the path model. When student attendance records were aggregated by classroom, there was no difference in attendance for the SIM and non-SIM groups.

SUMMARY

This paper introduced the School Improvement Model project which is aimed at identifying a process of developing and implementing a teacher performance evaluation system, an administrator performance evaluation system, a staff inservice program, and a student achievement testing system. The relationships among these links to increased school effectiveness will be examined upon completion of the project to answer several research questions. A model for evaluating the effect of SIM activities on student achievement was presented and includes two major

components: testing group differences when classroom is the unit of analysis and developing a path model identifying the effect of variables included in the measure of student achievement.

Results of the path model indicate interrelationships among the predetermined variables, the intervening variables, and the criterion posttest scores. For this illustration (4th grade math NRT in a large, urban organization), pretest score, race, attendance, SES and SIM predict the individual posttest score. The importance of most of these variables had been suggested elsewhere (15,000 Hours), and their predictive ability is supported here. On an individual student basis, these preliminary findings indicate that SIM activities influence student achievement in a metropolitan school. The classroom analysis results were consistent with individual student results. Since this was a preliminary analysis, conclusions and accompanying inferences will depend upon the final analysis made during 1984. This final analysis will include analysis of 4th and 8th grade math CRT and NRT scores and 4th grade reading CRT and NRT scores. Similar analysis for various student achievement measures will be obtained on this final year's data before any conclusive evaluation of SIM's effectiveness can be proposed.

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